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Published in:
International Journal of Integrated Care

DOI:
10.5334/ijic.1359

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

International Journal of Integrated Care
ISSN 1568-4156
Volume 15, 24 June 2015
Publisher: Uopen Journals
URL:http://www.ijic.org
Cite this as: Int J Integr Care 2015; Apr–Jun; URN:NBN:NL:UI:10-1-114832

Submitted: 1 November 2013, revised 15 May 2015, accepted 19 May 2015

Research and Theory

The common characteristics and outcomes of multidisciplinary collaboration in primary health care: a systematic literature review

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Abstract

Introduction: Research on collaboration in primary care focuses on specific diseases or types of collaboration. We investigate the effects of such collaboration by bringing together the results of scientific studies.

Theory and methods: We conducted a systematic literature review of PubMed, CINAHL, Cochrane and EMBASE. The review was restricted to publications that test outcomes of multidisciplinary collaboration in primary care in high-income countries. A conceptual model is used to structure the analysis.

Results: Fifty-one studies comply with the selection criteria about collaboration in primary care. Approximately half of the 139 outcomes in these studies is non-significant. Studies among older patients, in particular, report non-significant outcomes ($p < .05$). By contrast, a higher proportion of significant results were found in studies that report on clinical outcomes.

Conclusions and discussion: This review shows a large diversity in the types of collaboration in primary care; and also thus a large proportion of outcomes do not seem to be positively affected by collaboration. Both the characteristics of the structure of the collaboration and the collaboration processes themselves affect the outcomes. More research is necessary to understand the mechanism behind the success of collaboration, especially on the exact nature of collaboration and the context in which collaboration takes place.

Keywords

primary health care, inter-professional relations, multidisciplinary collaboration, integrated care, outcomes

Introduction

Many countries stimulate collaboration between different disciplines in primary care and between primary care and other sectors [1]. There is a general agreement that collaboration is a way to establish a sustainable and affordable health care system. But to date the scientific evidence for this is ambiguous [1–3]. Nevertheless, policymakers, health care professionals and researchers strongly advocate the potential benefits such as increased efficiency-particularly regarding costs-more satisfaction for professionals allowing them to perform a greater variety of roles and better health outcomes for patients [4,5].

Earlier research on collaboration does not always show these benefits [4,6,7]. Most of the studies conclude that, even now, little is known about the direct impact on outcomes of collaborative working in primary health care. This is in spite of the large body of studies on this topic. A key problem is that collaborative care models are examples of 'complex interventions' which consist of a number of separate elements. The particular elements that function as the 'active ingredient' can be difficult to identify [8].

There are often two main problems with studies on collaboration in primary health care that can lead to ambiguous results. The first problem is that most studies focus on one specific diagnosis or group of patients. This makes their results difficult to compare and as a result does not provide reliable evidence on how far general conclusions can be drawn from their outcomes. In addition, it also creates the risk of new and probably unnecessary separate 'silos' where people operate in isolation, such as care professionals organized and collaborating around one specific condition [9] and thus leaving no room for organizing and evaluating care in an holistic, integrated way [9,10]. Moreover, focusing on a specific diagnosis or group of patients denies the increasing multi-morbidity in most western countries [11,12], and this focus thus might not work for these more complex patients.

The second problem is that the actual collaboration, meaning the form and the activities carried out in collaboration, is poorly described. As a result, no replication, evidence synthesis and implementation in different situations can be carried out [8]. Therefore, it is hard to judge what actions in general are more successful or unsuccessful [13].

This review tries to overcome these problems by bringing together the studies on collaboration regardless of all their different patient populations, collaboration characteristics and activities. By doing so, and by identifying similarities between studies, a new light is shed on the outcomes of collaboration. To our knowledge, earlier reviews have never taken this approach. This conceptual model is based on the structure, process and outcomes model of Donabedian [14] and is adapted to collaboration in primary care. It is used to guide the research and analysis in this paper and to answer the main question: 'What structures and processes of multidisciplinary collaboration in primary health care are reported in scientific literature and what conclusions can be drawn about its effect on patients' and professionals' outcomes?'

Methods

Search strategy

A Systematic Literature Review was performed to select and analyse scientific publications on collaboration in primary care. PubMed, CINAHL, Cochrane Library and EMBASE were searched for relevant studies in July 2014. We developed a Boolean search strategy for PubMed incorporating potential synonyms. The elements of our research question determined the search terms (MeSH). This search strategy was fine-tuned for the other databases. We searched under the four categories: (1) Multidisciplinary, (2) Collaboration, (3) Primary Health Care and (4) Outcomes. The search strategy was executed by combining all the terms within one type of search term to search for synonyms within (1), (2), (3) and (4)) together with a Boolean 'OR' operator. The four sets of terms were joined together with the 'AND' operator. All search terms for the electronic databases are available as a supplement.

Criteria for including or excluding studies for this review

The inclusion criteria are:

- Language: English, Spanish, German and Dutch, as these are the languages we understand.
- Countries: 68 member states of the World Health Organization that fall into the category of high income countries in 2011.

- Methods: Only studies with quantitative data as primary outcomes had to be defined in quantitative measures. This makes it possible to compare the primary outcomes and judge them on their significance.
- Object of study: Does it describe an intervention with activities carried out in collaboration in primary care? Some form of communication between the disciplines involved in the care provided had to be part of the collaboration, while studies about the training of undergraduates within schools or universities were excluded.
- The article describes outcomes for patients, primary health care professionals or organizations. Studies that only reported on costs without reference to other outcomes were excluded, since this was not the main focus of our paper.

Screening process

Figure 1 shows the results of the screening process. The search initially yielded 3535 unique references over the four databases. These were first assessed on the title and next on the abstract. If neither covered multidisciplinary collaboration, the article was excluded. The first 10% of the abstracts were reviewed by two reviewers (SMS and JH). Subsequently, the researchers resolved any disagreements by discussion and made the inclusion criteria more explicit. The remaining abstracts were reviewed by either one or the other. Next, the full text of 155 publications selected were reviewed independently by five reviewers (SMS, RB, DB, IP and JH). SMS read all publications and RB, DB, IP and JH read a part of all references. In this way, every publication was read by two reviewers. The inter-rater reliability kappa of the researchers giving exactly the same judgement is 0.73 ($p < 0.05$) which means the agreement is substantial. The few disagreements were resolved by discussion. In two cases, the full text of the publications was read by a third reviewer in order to resolve the disagreements that could not be solved by discussion.

The literature identified was dominated by case studies that did not report quantitative data and analysis and were therefore excluded. The same applies to studies where there is a main focus on another subject other than collaboration. We also excluded 12 reviews which were relevant studies but which had already been retrieved in our own search. This indicated that our search strategy was valid. Eventually 51 studies remained after duplicates were eliminated and studies were excluded based on title, abstract and full text.

Quality assessment

We used the criteria of Cochrane Collaborations Effective Practice and Organization of Care (EPOC) [15] to assess the quality of the studies since the question posed by this research asks for more than just experimental study designs. We wished to investigate the effects of context on the effectiveness of an intervention. However, we also expanded the criteria with non-experimental designs, such as cohort studies and cross-sectional studies [16]. These studies were judged and scored on the quality of their methods. The quality rating of the studies included differed [high, moderate or low risk of bias (see Appendix, Table 2)]. A study was judged as having a low risk of bias if it met all seven criteria, a moderate risk of bias if it met four to six criteria and a high risk of bias if it met three criteria or fewer [15]. The designs that did not follow the EPOC criteria were judged as having a high risk of bias and, thus, a low quality, as these lack evidence when studying the effects of interventions. These studies with very low quality were excluded.

The conceptual model

The studies found show similarities. These similarities were structured by the structure, process and outcomes model of Donabedian [14]. This model was applied to shed more light on the elements and effects of collaboration in primary care (Figure 2). By ‘structure’, we mean how the characteristics in which the collaboration is embedded were defined [14]. It includes the factors: (1) the team composition that is the presence of a primary care physician in the collaboration [17]; (2) the number of disciplines working together, that is the size of the collaboration; (3) the patient population described by patients’ age and patients’ condition; and (4) the number of sectors included in the collaboration. The process characteristics concern the way collaboration is actually shaped in practice that is the way in which care is delivered in collaboration, including the processes between different people [18,19]. Three main types of collaboration processes have been discerned in the studies. The collaboration was shaped by the introduction of some kind of integrated, multidisciplinary care plan, by implementing multidisciplinary meetings and by the introduction of some kind of coordination of care or case management. In his model, Donabedian looks at ‘outcomes’ as the effects of health care on patients or populations, including changes in health status (clinical

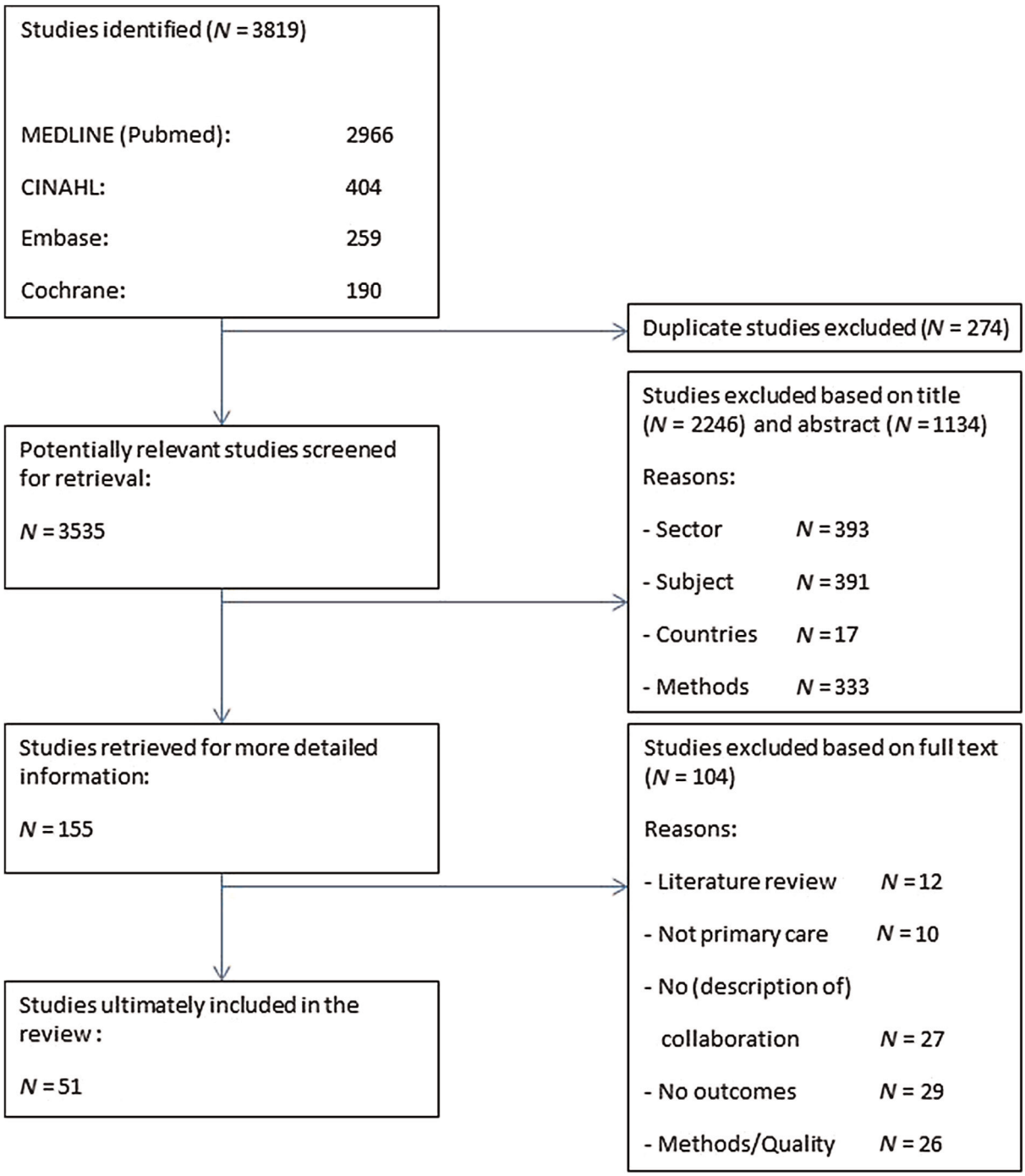

Figure 1. The screening process.

outcomes), behaviour or knowledge as well as patient satisfaction and health-related quality-of-life (patient-related outcomes) [14]. Other models and studies include outcomes such as organizational effectiveness, use of health services such as referrals, or the commitment or satisfaction of professionals [5]. In our review, we added such outcomes for organizations and for professionals, to the conceptual model. We grouped the outcome parameters used in the studies into four types: measures reported by patient such as health status, activities of daily living or patient satisfaction; clinical outcomes such as systolic blood pressure or HbA1c; the utilization of health care such as hospital admissions or use of emergency services (all outcomes for patients); and outcomes reported by professionals such as costs or job satisfaction (see Appendix). This review focused on outcomes for patients and professionals.

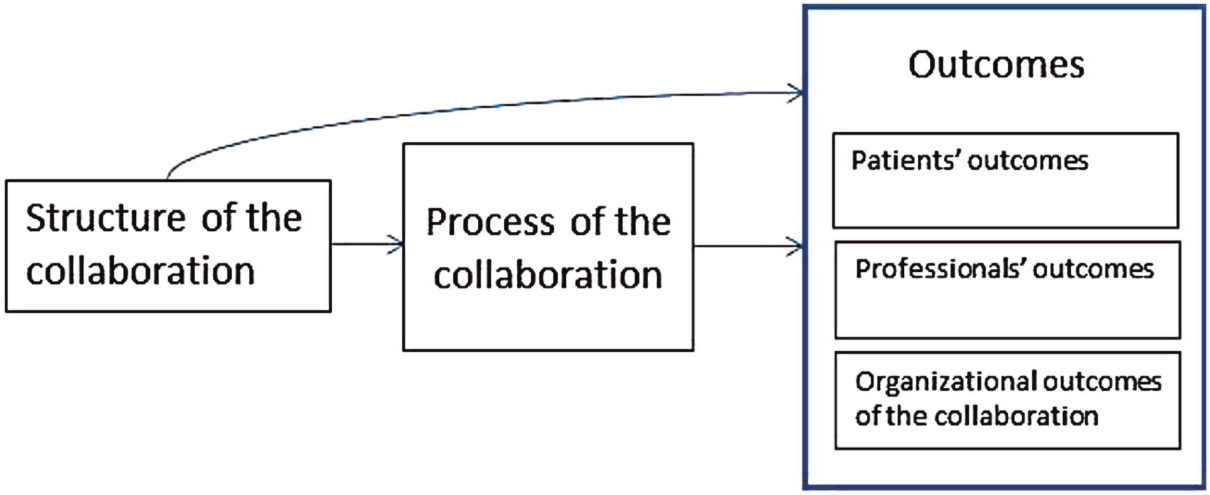

Figure 2. Conceptual model to analyse studies on collaboration in primary health care.

Analysis

We conducted the analyses in two steps. First, the studies were coded and mapped according to the elements of our conceptual model: structure, process and outcomes (see Figure 1). Here, the process activities were limited to the three activities that were most commonly used. Those activities were: (1) a care plan for each individual developed by a multidisciplinary group of professionals; (2) multidisciplinary meetings; and (3) case management. Second, the outcomes reported in the publications were pooled. In doing so, this second analysis was performed on the level of the outcomes of the interventions, not on publication level. The 139 outcomes were coded as being statistically and positively significant (1) or not (0).This provided more detail on the outcomes of the studies, which would be missed if we had only reported on the publication level. Due to the, still small, number of outcomes, tests were only performed if the total set of the outcomes and its significant percentage was at least 10. We tested if the total of the different structural characteristics of the interventions are related to the significance of its outcomes. Likewise, we tested if the significance of the intervention is related to the different process activities of the intervention. The test we performed was a two-proportion *z*-test. It is used to determine whether the difference between two proportions is significant.

Results

Analysis 1: the characteristics of all 51 empirical studies

The largest share of studies in this review was conducted in the USA (*N* = 22) [17,20–40], Canada (*N* = 8) [41–48] and the UK (*N* = 7) [49–55]. Five studies investigated the Netherlands [56–60], two Sweden [61,62], and one study each was from Belgium [63], New Zealand [64], France [65], Spain [66], Israel [67], Australia [68] and Puerto Rico [69]. The largest share of study designs is randomized controlled trials (*N* = 18) [17,27,29,31–34,38,39,42,43,50,54–56,60,64,69] and controlled clinical trials (*N* = 5) [25,26,45,48,61]. All studies were published between 1993 and July 2014. The length of the intervention differed between the studies and was not always described. However, the duration of the research and the time between the first and last measurement was described. This was on average 14 months, ranging from 3 to 48 months. The conditions of the patients included in the studies and collaborations are: chronic conditions, 19 studies of which 7 related to diabetes and 3 to uncontrollable hypertension; multiple mental conditions comprising 10 studies of which 7 were about depression; and 22 studies in which conditions are not specified. The key characteristics of the studies included in this review are summarized in Appendix.

Table 1 compares the structural characteristics with the process activities of the 51 studies selected. Patients individual care plans and multidisciplinary meetings were implemented to improve the collaboration processes in a majority of the studies, 23 and 20 studies, respectively.

Care coordination by a case manager is the third most frequently found activity, occurring in 13 studies. A GP/physician was involved in the collaboration in the majority of the interventions. Most (60%) of the interventions are

Table 1. Structure and process characteristics of the interventions (*N* = 51 studies)

	ICP (*N* = 23)	MM (*N* = 20)	Coordination of care (*N* = 13)	Total papers (*N*)
Presence of a physician				
No GP/physician present	2	2	2	5
GP/physician present	21	18	11	46
Number of disciplines				
Small collaboration (2 or 3 disciplines)	11	6	5	19
Medium/large collaboration (4 or more)	12	14	7	30
Patient age				
Older patients	11	7	7	18
Other	12	13	6	33
Patient condition				
Chronic condition	8	6	5	19
Mental illness	4	5	3	10
Other conditions	11	9	5	22
Sector				
Within primary care	13	5	6	23
Primary care and 1 or more other sectors	9	15	6	25

ICP, individual care plan; MM, multidisciplinary meetings

medium or large collaborations involving four or more different disciplines rather than small collaborations. Interventions that included two or three different collaborating disciplines use individual care plans more frequently. However, interventions where four or more different disciplines are involved more frequently collaborate through multidisciplinary meetings. A relatively large share of interventions, occurring in 18 papers, focused on an older patient population.

The majority of these interventions work with individual care plans. Studies about other age categories, some non-specific, describe interventions more frequently with multidisciplinary meetings.

The interventions are often targeted at patients with chronic, or multiple chronic, conditions (19 studies), or at patients with mental, or multiple mental illnesses (10 studies). Eight studies tested interventions that use individual care plans for patients with one or more chronic conditions. The studies describe not only interventions involving collaborations within primary care itself, but also half of them (25 studies) involve interventions between primary care and one or more other sectors such as mental health or secondary care. Interventions about collaborations within primary care mostly use individual care plans. However, interventions involving collaboration with different sectors such as mental health or secondary care are more frequently carried out through multidisciplinary meetings.

The structure and process characteristics of the interventions are related to the outcome parameters used in the studies in Table 2. Most studies report the clinical outcomes resulting from the interventions (25 studies) or outcomes related to the patient (23 studies). Almost all studies report more than just one type of outcome parameter. Only two studies show outcomes from the collaborations where there was no physician involved. The following structural characteristics of the interventions test the outcomes related to the patient more frequently: collaborations with four or more different disciplines; older people; patients with a mental illness; patients with other conditions or where their conditions were not specified; and collaborations in more than one sector. The studies which most often report clinical outcomes were: interventions involving small collaborations, interventions that included patients with chronic or multiple chronic conditions and collaborations within primary care. Studies about multidisciplinary meetings most frequently report outcomes related to the patient, whereas the four different categories of outcomes are spread over the other activities.

Table 2. Structure and process characteristics of the interventions related to the type of outcome parameters used in the studies (*N* = 51 studies)

	PRM (*N* = 23 papers)	CO (*N* = 25 papers)	UHS (*N* = 13 papers)	PRO (*N* = 13 papers)	Total papers (*N*)
Presence of a physician					
No GP/physician present	2	2	1	1	5
GP/physician present	21	23	12	12	46
Number of disciplines					
Small collaboration (2 or 3 disciplines)	9	14	5	6	19
Medium/large collaboration (4 or more)	14	11	8	7	30
Patient age					
Older patients	15	10	7	4	18
Other	8	15	6	9	33
Patient condition					
Chronic condition	7	15	3	4	19
Mental illness	4	1	1	2	10
Other conditions	12	9	9	7	22
Sector					
Within primary care	9	17	6	5	23
Primary care and 1 or more other sectors	14	8	6	8	25
Process					
Integrated care plan	13	13	7	6	23
Multidisciplinary meetings	14	7	5	7	20
Coordination of care	8	5	4	2	13

PRM, patient-reported outcomes; CO, clinical outcomes; UHS, use of health services; PRO, professional-reported outcomes

Analysis 2: the 139 outcomes reported in the 51 studies

One hundred and thirty-nine different outcomes were reported in the 51 studies. Taking these 139 outcomes as the unit of analysis provides an opportunity to estimate what evidence is present to suggest a successful collaboration and to what extent the structures and processes of the collaborations are related to success. Of the studies in this review, 16 studies did not show any significant outcomes. Table 3 shows the four types of outcome parameters and the proportion of statistically significant outcomes related to the structure or process characteristics of the interventions. The largest share of the 139 reported outcomes is clinical (50 outcomes). These were also most frequently found to be positive and significant (54%).

The last column of Table 3 shows the results of the two-proportion *z*-tests. When tested there was no significant difference between interventions with or without a physician involved in the collaboration. Neither did we find that medium or large interventions, in terms of number of disciplines involved, coincide more often with positive and statistically significant effects for each type of outcome. In the case of smaller collaborations, the only category that was most likely to be significant is the proportion of clinical outcomes. However, these specific outcomes were not tested because of the small number. When comparing non-specific age groups to older people, there is a significant difference in the outcomes. Non-specific age groups more often show a positive significant outcome ($p < .05$). It is only for the outcome category 'use of health services' that a higher proportion of positive and significant outcomes was reported for interventions targeted at older people. There is no significant difference in outcomes between the patients' conditions. Table 3 shows that interventions for patients with physical or multiple physical chronic conditions report more significant clinical outcomes (not tested). It seems that inter-sectoral interventions outperform interventions within primary health care. However, this is not significant.

When looking at the collaborative activities, that is the type of collaboration process, care coordination interventions have the highest proportion of significant effects on the four different outcomes. In general, if interventions report

Table 3. % significant positive effects of structure and process characteristics of collaboration on outcomes (*N* = 139 outcomes)

	PRM		CO		UHS		PRO		Total	
	N **outcomes**	**% significant**	***N*** **outcomes**	**% significant**	***N*** **outcomes**	**% significant**	***N*** **outcomes**	**% significant**	**N outcomes**	**% significant**
Total	45	38%	50	54%	24	46%	20	50%	139	47%
Collaboration structure										
No GP/physician	3	33%	6	50%	1		1		11	45%
GP/physician	42	38%	44	55%	23	43%	19	53%	128	47%
Number of disciplines										
Small collaboration (2 or 3 disciplines)	20	25%	21	62%	11	36%	8	25%	60	40%
Medium/large collaboration (4 or more)	25	48%	29	48%	13	54%	12	67%	79	52%
Patient age										
Older people	33	36%	14	36%	15	47%	5	20%	67	37%*
Other	12	42%	36	61%	9	44%	15	60%	72	56%*
Patient condition										
Chronic condition	11	9%	35	63%	5	80%	6	33%	57	51%
Mental illness	8	38%	1		2		5	60%	16	38%
Other conditions	26	50%	14	36%	17	41%	9	56%	66	45%
Sector										
Within primary care	18	33%	31	48%	7	29%	6	33%	62	40%
Primary care and 1 or more other sectors	27	41%	19	63%	15	60%	14	57%	75	53%
Collaboration process										
Individual care plan developed in collaboration	26	27%	22	45%	16	38%	8	25%	72	35%
Multidisciplinary meetings	26	38%	15	40%	11	45%	12	58%	64	44%
Case management	20	45%	10	70%	4	50%	3	33%	37	51%

PRM, patient-reported outcomes; CO, clinical outcomes; UHS, use of health services; PRO, professional-reported outcomes
*$p < .05$ (within each characteristic is tested with a two-proportion *z*-test)

using multidisciplinary meetings, they show relatively more outcomes and significant outcomes in those outcomes related to a professional. Individual care plans most often report positive outcomes on clinical outcomes.

Discussion

The objective of this study was to perform a review of scientific papers that present empirical results about multidisciplinary collaborations in primary health care and their effect on patients' and professionals' outcomes. We believe this review is the first in which empirical studies on collaboration in primary care and its outcomes, and not limited to specific patient groups or diseases or the type of collaboration, are compared and analysed.

The studies found in this review reported on the structure and outcomes. However, the processes were often poorly described and monitored. As a consequence, it remains difficult to investigate the expectation that processes could be as important as structures for outcomes of primary care collaborations. However, of the process activities, the three most reported and clearly described activities were extracted from the studies and tested in this review. Because of a small number of studies and outcomes, the three components of the conceptual model could not be tested simultaneously.

Most of the 51 studies analysed focused primarily on the outcomes for patients. A few studies reported outcomes for professionals. The underlying reason for this might be that outcomes for patients are considered to be the most important and therefore these are the most researched. However, it remains relevant to investigate too if collaborations that show better outcomes for professionals also lead to better care for patients. In future research this aspect should be taken into account.

The 51 papers and the 139 outcomes reported in this review show that collaboration in primary care equally does, and does not, result in positive and significant outcomes. The proportion of significant outcomes in the 51 papers is lower than 50%. We believe this is a significant insight given the common belief that collaboration in primary care will generally result in greater efficiency-including cost efficiency, greater professional satisfaction due to task enrichment and better health outcomes for patients. We find that this is *not* supported by the collaborations reported in the studies and analysed in this review. We believe there are possible reasons why the results of collaboration in our review are disappointing:

- Collaboration is not leading to better outcomes, at least not all types of collaboration interventions lead to better outcomes;
- The intervention involved in the collaboration was not implemented properly in some of the studies. For instance, a protocol was introduced but not all professionals adhered to it.
- The research project was not able to identify the effect on outcome.

All three reasons are plausible given our results. It might be that some interventions are less successful, for instance for older people. Also, the idea of the collaboration may not sometimes have been implemented properly. However, the last reason seems the most plausible in our review. First, the quality of the studies might result in a bias towards the opportunity to find significant outcomes. By using the EPOC tool, the risk of bias in the studies was screened out, leading to exclusion of studies of very low quality (26 based on full text). However, there remained 21 studies of low quality included in this review. This low quality could have influenced the results and could lead to them becoming less significant. Second, the sensitivity of the outcomes we measured limits the opportunity to find significant outcomes. Some outcomes are harder to improve by investing in collaboration than others. Studies that do show an improvement mostly concern clinical outcomes. This is probably related to the fact that collaborations which focused on specific diseases have better conditions to show clinical outcomes. In general, the clinical effects in one specific patient group can be better quantified and are more easily achieved in a shorter time. Finally, the follow-up in the measurements might be too short a period of time for outcomes to be realized. The studies in this review varied in their period of measurement from three months to four years. We did not account for this as it was beyond the scope of this review. However, the review of Kruis [7] showed that in the short term (three to 12 months) almost all outcomes for patients with anxiety and depression improved, but in the long term (>12 months) the effect remained unclear. Outcomes require some time but this does not automatically hold true for the longer term. The three reasons should be taken into account in further attempts to implement collaboration and in the monitoring of research.

The large number of studies in this review that address the involvement of primary care physicians reflect perhaps the dominant and crucial position that physicians have in many health care systems. Some characteristics of the structure of collaborations show higher positive significant outcomes, such as the involvement of a physician in the collaboration compared to no involvement of a physician (not significant). The paper of Poulton [53] showed

that the size and effectiveness of the team in health care collaboration are not related. Our review supports this finding. Although other studies [70] reveal that it is harder to collaborate when more disciplines are involved, we found the opposite: the proportion of significant clinical outcomes is higher if collaborations involve more disciplines. Furthermore, we found that interventions for patients with chronic conditions show more significant clinical outcomes and use of health services if multidisciplinary collaborations are involved. This support claims that for this group of patients gains from collaboration can be achieved [71–73].

It is suspected that collaborating between sectors can have more language or payment barriers [53]. This is not found to be the case in this review. Collaborations between primary care and providers from other sectors show no significant difference from other collaborations. However, regarding the characteristics of the structure, only the non-specific age groups show a significant difference than with older people. Collaborations that are directed towards older patients show less positive significant clinical and patient-related outcomes and did not offer any extra benefit for professionals. This might be understood by the fact that older people more often have multiple chronic diseases and are more fragile. As a consequence, improving collaboration for this group of patients, though important, is difficult to establish. This is probably why it is harder, compared to other groups, to improve the clinical and patient-related outcomes in general, and specifically, through better collaboration. This might also result in lower satisfaction for the professionals who are involved in such collaboration projects. This result challenges the assumption that more collaboration is the best way to improve the health care services for older patients.

When it comes to the process of collaboration, it appears most beneficial to implement some form of care coordination, especially when trying to improve clinical and patient-related outcomes. However, the difference in outcomes between the activities is small. Collaborations that include multidisciplinary meetings more often than the other activities show a higher proportion of significant outcomes for professionals. This may indicate that these meetings help professionals simply get to know each other and thus stimulate team building [18].

Limitations

Interventions to improve collaboration show a large variation in the structure of the collaboration, the actual collaboration process that is improved and in the implementation of the interventions. However, grouping the interventions by their characteristics of structure and process reveals significant patterns.

Nevertheless, the results may be subject to both a publication and study selection bias. Publication bias may occur as studies will be more likely to get published when the outcomes show an effect. This could overestimate the proportion of significant outcomes. At the same time, we find that 16 of the 51 studies in this review did not report any positive significant effect. Study selection bias occurs as this review is limited to studies using quantitative data from high-income countries. As a result, general conclusions should not be applied to other, middle- or low-income countries. Our selection of databases in health care could also have resulted in a study selection bias. Still, these databases are the most common and suitable to retrieve studies on collaborations and outcomes in health care. This was reflected by the fact that all relevant studies incorporated in previous reviews were also found in our search strategy and in the databases we used. Moreover, the selection process included a selection on outcomes, which excluded some studies such as those on costs alone.

The study selection was first undertaken on title and later on abstract and on full text. The selection on title might have excluded studies with a title giving no clue about the objective of the study. However, when in doubt the study's abstract was screened.

Our data set is essentially cross-sectional and the numbers involved are rather small. We tried to overcome this shortcoming by testing on the number of outcomes (N = 139), instead of focusing on the number of studies (N = 51). Still, this number is too small for multivariate analysis. Therefore, it is not possible to draw causal inferences on the effect of the type of study and the outcomes involved. To overcome problems with multiple testing, a two-proportion z-test is used. By reducing the analysis to separate structures and activities, the variation is made as small as possible, and comparisons are made on the level of these separate elements. For example, the three most reported activities were chosen for the analysis. Unfortunately, the intensity and quality of these actions could not be taken into account because of a poor description.

Much research on collaboration has been carried out, often focusing on small parts of a collaboration [25,74,75]. But in this review, all the different studies are combined and compared, for example collaborative initiatives for type 2 diabetes patients compared to studies on patients with mental health. This should not be a problem since the

collaborative activities carried out are often the same, for example a multidisciplinary meeting or care coordination. Moreover, the strength of this review lies in focusing on outcomes rather than individual studies.

In conclusion we argue that:

- Until now collaboration in many studies does not live up to its expectations with less than 50% of the outcomes positive and significant. However, this might be the problem of the quality of the studies, the expectation riding on some outcomes and the follow-up time;
- A higher proportion of significant results of collaboration was found in studies that report on clinical outcomes;
- Many studies suggest collaboration for older people is unsuccessful.

The important implications for daily practice are that implementation of a collaboration resulting in outcomes takes time and effort, especially in the long run. It is important to monitor the process and special attention is required for older patients.

Acknowledgement

This work was supported in part by the Primary Care Focus programme of The Netherlands Organization for Health Research and Development.

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References

1. Xyrichis A, Ream E. Teamwork: a concept analysis. Journal of Advanced Nursing 2008;61(2):232–41. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18186914.
2. Minkman M, Ahaus K, Fabbricotti I, Nabitz U, Huijsman R. A quality management model for integrated care: results of a Delphi and Concept Mapping study. International Journal for Quality in Health Care 2009;21(1):66–75. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18945745.
3. Shortell SM, Gillies RR, Anderson DA, Erickson KM, Mitchell JB. Integrating health care delivery. Health Forum Journal 2000;43(6):35–39. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11186660.
4. Lemieux-Charles L, McGuire WL. What do we know about health care team effectiveness? A review of the literature. Medical Care Research and Review 2006;63(3):263–300. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16651394.
5. Minkman MMN, Vermeulen RP, Ahaus KJ, Huijsman R. The implementation of integrated care: the empirical validation of the Development Model for Integrated care. BMC Health Services Research 2011;11:177. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21801428.
6. Archer J, Bower P, Gilbody S, Lovell K, Richards D, Gask L, et al. Collaborative care for depression and anxiety problems. Cochrane Database of Systematic Reviews 2012;10:Art. No.: CD006525.
7. Kruis AL, Smidt N, Assendelft WJJ, Gussekloo J, Boland MRS, Rutten-van Mölken M, et al. Integrated disease management interventions for patients with chronic obstructive pulmonary disease. Cochrane Database of Systematic Reviews 2013;10:Art. No.: CD009437.
8. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. International Journal of Nursing Studies 2013;50(5):587–92. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23159157.
9. Ham C, Walsh N. Making integrated care happen at scale and pace. London: The King's Fund; 2013.
10. Valentijn PP, Schepman SM, Opheij W, Bruijnzeels MA. Understanding integrated care: a comprehensive conceptual framework based on the integrative functions of primary care. International Journal of Integrated Care 2013;13:e010. Available from: URN:NBN:NL:UI:10-1-114415.
11. Vos J, Windle K, Siriwardena N, Linehan C. Cast adrift in the care system? A systematic scoping review of care navigation for older people with multimorbidity. In: International Conference: Aging and Society, 7–8 Nov 2014, Manchester.
12. Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, et al. Aging with multimorbidity: a systematic review of the literature. Ageing research reviews 2011;10(4):430–9. Available from: http://www.sciencedirect.com/science/article/pii/S1568163711000249.

13. Pettigrew AM, Woodman RW, Cameron KS. Studying Organizational Change and Development: Challenges for Future Research. The Academy of Management Journal 2001;44(4):697–713. Available from: http://www.jstor.org/stable/3069411.
14. Donabedian A. Evaluating the quality of medical care. The Milbank Memorial Fund Quarterly 1966;44(3):(Suppl. 206. Available from: http://www.ncbi.nlm.nih.gov/pubmed/5338568.
15. CEP & OCR Group. The data collection checklist. Ottawa: Institute of Population Health, University of Ottawa; 2002.
16. Rockers PC, Feigl AB, Rottingen JA, Fretheim A, de FD, Lavis JN, et al. Study-design selection criteria in systematic reviews of effectiveness of health systems interventions and reforms: A meta-review. Health Policy 2012;104(3):206–14. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22325150.
17. Shaw EK, Ohman-Strickland PA, Piasecki A, Hudson SV, Ferrante JM, McDaniel RR Jr., et al. Effects of facilitated team meetings and learning collaboratives on colorectal cancer screening rates in primary care practices: a cluster randomized trial. Annals of Family Medicine 2013;11(3):220–8, s1–8. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3659138/pdf/0110220.pdf.
18. Xyrichis A, Lowton K. What fosters or prevents interprofessional teamworking in primary and community care? A literature review. International Journal of Nursing Studies 2008;45(1):140–53. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17383655.
19. Donabedian A. An introduction to quality assurance in health care. New York: Oxford University Press; 2003.
20. Hern T, Talen M, Babiuch C, Durazo-Arvizu R. Patient care management teams: improving continuity, office efficiency, and teamwork in a residency clinic. Journal of Graduate Medical Education 2009;1(1):67–72. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21975709.
21. Sommers LS, Marton KI, Barbaccia JC, Randolph J. Physician, nurse, and social worker collaboration in primary care for chronically ill seniors. Archives of Internal Medicine 2000;160(12):1825–33. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10871977.
22. Mukamel DB, Temkin-Greener H, Delavan R, Peterson DR, Gross D, Kunitz S, et al. Team performance and risk-adjusted health outcomes in the Program of All-Inclusive Care for the Elderly (PACE). Gerontologist 2006;46(2):227–37. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16581887.
23. Boult C, Reider L, Leff B, Frick KD, Boyd CM, Wolff JL, et al. The effect of guided care teams on the use of health services: results from a cluster-randomized controlled trial. Archives of Internal Medicine 2011;171:460–6.
24. Phelan EA, Balderson B, Levine M, Erro JH, Jordan L, Grothaus L, et al. Delivering effective primary care to older adults: a randomized, controlled trial of the senior resource team at group health cooperative. Journal of the American Geriatrics Society 2007;55:1748–56.
25. Counsell SR, Callahan CM, Clark DO, Tu W, Buttar AB, Stump TE, et al. Geriatric care management for low-income seniors: a randomized controlled trial. JAMA: The Journal of the American Medical Association 2007;298:2623–33.
26. Bray P, Thompson D, Wynn JD, Cummings DM, Whetstone L. Confronting disparities in diabetes care: the clinical effectiveness of redesigning care management for minority patients in rural primary care practices. Journal of Rural Health 2005;21:317–21.
27. Harpole LH, Williams JW, Olsen MK, Stechuchak KM, Oddone E, Callahan CM, et al. Improving depression outcomes in older adults with comorbid medical illness. General Hospital Psychiatry 2005;27:4–12.
28. Weber CA, Ernst ME, Sezate GS, Zheng S, Carter BL. Pharmacist-physician comanagement of hypertension and reduction in 24-hour ambulatory blood pressures. Archives of Internal Medicine 2010;170(18):1634–39. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20937921.
29. Schraeder C, Fraser C, Clark I, Newcomer R, Stoll J, Krock C, et al. The effect of primary care management on lipids testing and LDL-C control of elderly patients with comorbidities. Professional Case Management 2009;14(2):84–95. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19318900.
30. Famadas JC, Frick KD, Haydar ZR, Nicewander D, Ballard D, Boult C. The effects of interdisciplinary outpatient geriatrics on the use, costs and quality of health services in the fee-for-service environment. Aging Clinical and Experimental Research 2008;20(6):556–61. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19179840.
31. Borenstein JE, Graber G, Saltiel E, Wallace J, Ryu S, Archi J, et al. Physician-pharmacist comanagement of hypertension: a randomized, comparative trial. Pharmacotherapy 2003;23(2):209–16. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12587810.
32. Burns R, Nichols LO, Martindale-Adams J, Graney MJ. Interdisciplinary geriatric primary care evaluation and management: two-year outcomes. Journal of the American Geriatrics Society 2000;48(1):8–13. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10642014.
33. Bogden PE, Koontz LM, Williamson P, Abbott RD. The physician and pharmacist team. An effective approach to cholesterol reduction. Journal of General Internal Medicine 1997;12(3):158–64. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9100140.
34. Bogden PE, Abbott RD, Williamson P, Onopa JK, Koontz LM. Comparing standard care with a physician and pharmacist team approach for uncontrolled hypertension. Journal of General Internal Medicine 1998;13(11):740–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9824519.
35. Le CT, Winter TD, Boyd KJ, Ackerson L, Hurley LB. Experience with a managed care approach to HIV infection: effectiveness of an interdisciplinary team. American Journal of Managed Care 1998;4(5):647–57. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10179919.

36. Emery EE, Lapidos S, Eisenstein AR, Ivan II, Golden RL. The BRIGHTEN program: implementation and evaluation of a program to bridge resources of an interdisciplinary geriatric health team via electronic networking. Gerontologist 2012;52(6):857–65. Available from: http://gerontologist.oxfordjournals.org/content/52/6/857.full.pdf.
37. Singh-Franco D, Perez A, Wolowich WR. Improvement in surrogate endpoints by a multidisciplinary team in a mobile clinic serving a low-income, immigrant minority population in South Florida. Journal of Health Care for the Poor and Underserved 2013; 24(1):67–77. Available from: http://muse.jhu.edu/journals/journal_of_health_care_for_the_poor_and_underserved/v024/24.1.singh-franco.pdf.
38. Bogner HR, Morales KH, de Vries HF, Cappola AR. Integrated management of type 2 diabetes mellitus and depression treatment to improve medication adherence: a randomized controlled trial. Annals of Family Medicine 2012;10(1):15–22. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=2011423572&site=ehost-live.
39. Cohen LB, Taveira TH, Khatana SA, Dooley AG, Pirraglia PA, Wu WC. Pharmacist-led shared medical appointments for multiple cardiovascular risk reduction in patients with type 2 diabetes. Diabetes Educator 2011;37(6):801–12. Available from: http://tde.sagepub.com/content/37/6/801.long.
40. Tsan JY, Zeber JE, Stock EM, Sun F, Copeland LA. Primary care-mental health integration and treatment retention among Iraq and Afghanistan war veterans. Psychological Review 2012;9(4):336–48. Available from: http://psycnet.apa.org/journals/ser/9/4/336/.
41. Tourigny A, Aubin M, Haggerty J, Bonin L, Morin D, Reinharz D, et al. Patients' perceptions of the quality of care after primary care reform: family medicine groups in Quebec. Canadian Family Physician 2010;56(7):e273–82.
42. Markle RM, Orridge C, Weir R, Browne G, Gafni A, Lewis M, et al. Interprofessional stroke rehabilitation for stroke survivors using home care. The Canadian Journal of Neurological Sciences 2011;38:317–34.
43. Hogg W, Lemelin J, Dahrouge S, Liddy C, Armstrong CD, Legault F, et al. Randomized controlled trial of anticipatory and preventive multidisciplinary team care: for complex patients in a community-based primary care setting. Canadian Family Physician 2009;55:e76–85.
44. Chomienne MH, Grenier J, Gaboury I, Hogg W, Ritchie P, Farmanova-Haynes E. Family doctors and psychologists working together: doctors' and patients' perspectives. Journal of Evaluation in Clinical Practice 2011;17(2):282–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20874836.
45. McKinnon A, Jorgenson D. Pharmacist and physician collaborative prescribing: for medication renewals within a primary health centre. Canadian Family Physician 2009;55(12):e86–91. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20008583.
46. Mitton C, O'Neil D, Simpson L, Hoppins Y, Harcus S. Nurse-Physician Collaborative Partnership: a rural model for the chronically ill. Canadian Journal of Rural Medicine 2007;12(4):208–16. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18076814.
47. Kisely S, Duerden D, Shaddick S, Jayabarathan A. Collaboration between primary care and psychiatric services: does it help family physicians? Canadian Family Physician 2006;52:876–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17273487.
48. Sellors J, Kaczorowski J, Sellors C, Dolovich L, Woodward C, Willan A, et al. A randomized controlled trial of a pharmacist consultation program for family physicians and their elderly patients. Canadian Medical Association Journal 2003;169(1): 17–22. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12847034.
49. Richmond S, Morton N, Cross B, Chi Kei Wong I, Russel I, Philips Z, et al. Effectiveness of shared pharmaceutical care for older patients: RESPECT trial findings. British Journal of General Practice 2010;60(570):e10–19. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19995493.
50. Chan WS, Whitford DL, Conroy R, Gibney D, Hollywood B. A multidisciplinary primary care team consultation in a socioeconomically deprived community: an exploratory randomised controlled trial. BMC Health Services Research 2011;11:15.
51. Greene A, Pagliari C, Cunningham S, Donnan P, Evans J, Emslie-Smith A, et al. Do managed clinical networks improve quality of diabetes care? Evidence from a retrospective mixed methods evaluation. Quality and Safety in Health Care 2009;18(6): 456–61.
52. Hull SA, Jones C, Tissier JM, Eldridge S, Maclaren D. Relationship style between GPs and community mental health teams affects referral rates. British Journal of General Practice 2002;52(475):101–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11885819.
53. Poulton BC, West MA. The determinants of effectiveness in primary health care teams. Journal of Interprofessional Care 1999;13(1):7–18.
54. Warner RW, Gater R, Jackson MG, Goldberg DP. Effects of a community mental health service on the practice and attitudes of general practitioners. British Journal of General Practice 1993;43(377):507–11. Available from: http://www.ncbi.nlm.nih.gov/pubmed/8312022.
55. Richards DA, Hill JJ, Gask L, Lovell K, Chew-Graham C, Bower P, et al. Clinical effectiveness of collaborative care for depression in UK primary care (CADET): cluster randomised controlled trial. British Medical Journal 2013;347:f4913. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3746956/pdf/bmj.f4913.pdf.
56. Melis RJ, van Eijken MI, Teerenstra S, van AT, Parker SG, Borm GF, et al. A randomized study of a multidisciplinary program to intervene on geriatric syndromes in vulnerable older people who live at home (Dutch EASYcare Study). Journal of Gerontology: Medical Sciences 2008;63(3):283–90. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18375877.
57. Boorsma M, Frijters DH, Knol DL, Ribbe ME, Nijpels G, van Hout HP. Effects of multidisciplinary integrated care on quality of care in residential care facilities for elderly people: a cluster randomized trial. Canadian Medical Association Journal 2011; 183(11):E724–32. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21708967.

58. Bosch M, Dijkstra R, Wensing M, van der Weijden T, Grol R. Organizational culture, team climate and diabetes care in small office-based practices. BMC Health Services Research 2008;8:180. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18717999.
59. Heideman J, Laurant M, Verhaak P, Wensing M, Grol R. Effects of a nationwide programme: interventions to reduce perceived barriers to collaboration and to increase structural one-on-one contact. Journal of Evaluation in Clinical Practice 2007; 13(6):860–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18070256.
60. Metzelthin SF, van Rossum E, de Witte LP, Ambergen AW, Hobma SO, Sipers W, et al. Effectiveness of interdisciplinary primary care approach to reduce disability in community dwelling frail older people: cluster randomised controlled trial. British Medical Journal 2013;347:f5264. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3769159/pdf/bmj.f5264.pdf.
61. Hultberg EL, Lonnroth K, Allebeck P. Interdisciplinary collaboration between primary care, social insurance and social services in the rehabilitation of people with musculoskeletal disorder: Effects on self-rated health and physical performance. Journal of Interprofessional Care 2005;19(2):115–24. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L40613227.
62. Johansson P, Lindahl E. Locking-in effects due to early interventions? An evaluation of a multidisciplinary screening programs for avoiding long-term sickness. Evaluation Review 2012;36(5):323–45. Available from: http://erx.sagepub.com/content/36/5/323.
63. Borgermans L, Goderis G, Van Den Broeke C, Verbeke G, Carbonez A, Ivanova A, et al. Interdisciplinary diabetes care teams operating on the interface between primary and specialty care are associated with improved outcomes of care: findings from the Leuven Diabetes Project. BMC Health Services Research 2009;9:179.
64. Bryant LJ, Coster G, Gamble GD, McCormick RN. The General Practitioner-Pharmacist Collaboration (GPPC) study: a randomised controlled trial of clinical medication reviews in community pharmacy. International Journal of Pharmacy Practice 2011;19(2):94–105. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21385240.
65. Younes N, Passerieux C, Hardy-Bayle MC, Falissard B, Gasquet I. Long term GP opinions and involvement after a consultation-liaison intervention for mental health problems. BMC Family Practice 2008;9:41. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18597695.
66. Menarguez Puche JF, Saturno Hernandez PJ. Descripción del clima organizacional en equipos de atención primaria de una comunidad autónoma [Description of the organizational climate in primary care teams in an autonomous community]. Atención Primaria 1999;23(5):280–4. [in Spanish] Available from: http://www.ncbi.nlm.nih.gov/pubmed/10341459.
67. Maislos M, Weisman D. Multidisciplinary approach to patients with poorly controlled type 2 diabetes mellitus: a prospective, randomized study. Acta Diabetologica 2004;41(2):44–48. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15224204.
68. Jiwa M, Longman G, Sriram D, Sherriff J, Briffa K, Musiello T. Cancer care coordinator: promoting multidisciplinary care – a pilot study in Australian general practice. Collegian 2013;20(1):67–73.
69. Vera M, Perez-Pedrogo C, Huertas SE, Reyes-Rabanillo ML, Juarbe D, Huertas A, et al. Collaborative care for depressed patients with chronic medical conditions: a randomized trial in Puerto Rico. Psychiatric Services 2010;61(2):144–50. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20123819.
70. Curoe A, Kralewski J, Kaissi A. Assessing the cultures of medical group practices. Journal of the American Board of Family Medicine 2003;16(5):394–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14645329.
71. Pimouguet C, Le Goff M, Thiébaut R, Dartigues JF, Helmer C. Effectiveness of disease-management programs for improving diabetes care: a meta-analysis. Canadian Medical Association Journal 2011;183(2):E115–27.
72. Ofman JJ, Badamgarav E, Henning JM, Knight K, Gano Jr. AD, Levan RK, et al. Does disease management improve clinical and economic outcomes in patients with chronic diseases? A systematic review. The American Journal of Medicine 117(3):182–92. Available from: http://www.amjmed.com/article/S0002-9343(04)00311-0/abstract.
73. Lemmens KM, Nieboer AP, Huijsman R. A systematic review of integrated use of disease-management interventions in asthma and COPD. Respiratory Medicine 2009;103(5):670–91.
74. van der Feltz-Cornelis CM, Van Os TW, Van Marwijk HW, Leentjens AF. Effect of psychiatric consultation models in primary care. A systematic review and meta-analysis of randomized clinical trials. Journal of Psychosomatic Research 2010; 68(6):521–33. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20488268.
75. Foy R, Hempel S, Rubenstein L, Suttorp M, Seelig M, Shanman R, et al. Meta-analysis: effect of interactive communication between collaborating primary care physicians and specialists. Annals of Internal Medicine 2010;152(4):247–58. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20157139.

Appendix
Selected studies

Table A1. Description of the selected studies (*N* = 51 papers)

	N	%
Internal structure of collaboration		
Disciplines		
GP/FP/physician	46	88
nurse	24	46
Pharmacist	17	33
Psychologist	13	25
Social worker	13	25
Dietician	9	17
Physiotherapist	8	15
Occupational therapist	7	13
Nurse practitioner	7	13
Psychiatrist	7	13
Geriatrician	5	10
Other	32	62
Number of different disciplines collaborating		
2	7	14
3	12	24
4	8	16
5	3	6
>5	19	38
Patient population		
Patient age		
Adults	5	10
Older adults	19	37
Not specified	28	54
Condition		
Chronic condition	14	27
Multiple chronic conditions	5	10
Mental illness	10	19
Other conditions	5	10
Not specified	17	33
Sector		
Primary care	23	44
Primary care and 1 other sector	21	40
Primary care and 2 other sectors	4	8
Primary care and 3 other sectors	1	2

Continues

Table A1. (Continued)

	N	%
Collaboration form		
Individual care plan	23	44
Multidisciplinary meetings	20	38
Care coordination	13	25
Sharing of information (i.e. charts or EMR)	5	10
Joint consultation	4	8
Multidisciplinary training	4	8
Multidisciplinary developed guideline	4	8
Patients group sessions	2	4
Other activities	12	23
Outcomes		
Patient-reported measures		
Health status (SF)	15	29
ADL	7	13
Quality-of-life	5	10
Functional performance (GARS)	3	6
Health utility (EQ-5D)	3	6
Reported changes in access	2	4
Continuity of care	2	4
Depression scale (HSCL-20)	2	4
Patients satisfaction	2	4
CES-D scale	2	4
Hospitalization	2	4
Other patient-reported measures	17	33
Clinical outcomes		
Systolic blood pressure	9	17
HbA1c	8	15
Diastolic blood pressure	4	8
Deaths/mortality number	4	8
Age-related cognitive impairment (MMSE)	3	6
Blood pressure	3	6
Total cholesterol	3	6
Drug/medications-related problems identified	2	4
Medication appropriateness index (UK-MAI)	2	4
LDL-C	2	4
Weight	2	4
Healthy diet	2	4
Other	11	21
Use of health care		
Number of hospital admissions	10	19
Use of emergency services	6	12

Continues

Table A1. (Continued)

	N	%
Use of health services	4	8
Referrals	2	4
Other	5	10
Professional-reported outcomes		
Direct costs	6	12
Job satisfaction	4	8
Team effectiveness	2	4
Health system costs	2	4
Other	11	21

ADL, activities of daily living; GARS, Groningen Activity Restriction Scale; CES-D Scale, Centre for Epidemiologic Studies-Depression Scale; MMSE, mini mental state examination; LDL-C, low density lipid cholesterol

Table A2. Objective, outcomes and quality of the selected studies

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[50]	Ireland	2011	To evaluate the effectiveness of a lengthened multidisciplinary team consultation in primary care in reducing anxiety and depression in mothers	Mothers with anxiety and depression in a socio-economically deprived community	Hospital Anxiety and Depression Scale, Mothers' health status (SF36v2) and schedule for the evaluation of individual quality-of-life (SEIQoL-DW)	Moderate quality
[42]	Canada	2010	To determine how to optimize the allocation of health services for this population	Stroke survivors	SF-36, Stroke Impact Scale (SIS-16), perceived social support via Personal Resource Questionnaire (PRQ-85-part2), depressive symptoms (CES-D), anxiety and depressive symptoms (Kessler-10), Cognitive function (SPMSQ), Reintegration to Normal Living Index, Number of strokes in the 12 months after randomization, Costs of use of all types of health services.	High quality
[23]	USA	2011	To measure the effect of guided care teams on multimorbid older patients' use of health services	Patients who were 65 years or older at risk(frail older persons)	Claims-based hierarchical condition category, use of health services obtained from paid insurance claims, use of long-term custodial nursing home days.	Moderate quality
[63]	Belgium	2009	To report on the effectiveness of primary care-based interdisciplinary diabetes care teams that are actively guided and supported by a specialist team from secondary care	Patients with type 2 diabetes	The proportion of patients reaching three clinical targets: 1) glycated hemoglobin (HbA1c) <7%, 2) systolic blood pressure $\leq$ 130mmHg and 3) low density lipid cholesterol < 100mg/dl. Total cholesterol, weight, physical exercise, healthy diet, smoking status, statin and anti-platelet therapy.	Moderate quality
[43]	Canada	2009	To examine whether quality of care improves when nurse practitioners and pharmacists work with family physicians in community practice and focus their work on patients who are 50 years of age and older and considered to be at risk experiencing adverse health outcomes	Patients of 50 years or older at risk	Process of chronic disease management, the use of emergency services and hospitalization, SF-36 and health-related quality-of-life scales, activities of daily living evaluations and self-reported emergency department visits and hospitalization.	Moderate quality

Continues

Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[24]	USA	2007	To evaluate a clinic-based geriatric team intervention designed to increase Primary care physicians' geriatric expertise. The primary aim was to determine whether the availability of a geriatric team altered the quality of care delivered to all older adults.	Patients aged 75 and older	Practice level outcomes: Primary care physician care reflective of geriatric principles (three geriatric principles: (1) optimal management of long-term conditions (hypertension), (2) careful prescribing (avoidance of prescribing high risk medications), and (3) proactive screening for selected geriatric syndromes). Primary care physician satisfaction with the SRT, provider self-efficacy for caring for older adults and provider satisfaction with system supports for caring for older adults. Patient level outcomes: Arthritis Impact Measurement Scale 2-Short Form (AIMS2-SF), new disability in any basic activities of daily living, self-rated health, psychological well-being (assessed using the Mental Health Index-5) and hospitalizations and deaths.	Moderate quality
[25]	USA	2007	To test the effect of the Geriatric Resources for Assessment and Care of Elders (GRACE) model of primary care on health outcomes of low-income seniors living in the community	Patients aged 65 years or older with low income	Depression severity (Patient Health Questionnaire-9), Quality of medical care (Assessing Care of Vulnerable Elders quality indicators), SF-36, instrumental and basic activities of daily living (assessed by the Assets and Health Dynamics of the Oldest-Old survey) and Emergency Department visits and hospitalizations, days in bed, patients' overall satisfaction with the care.	High quality
[26]	USA	2005	The study focuses on the patient outcomes from a demonstration project designed to investigate the feasibility of restructuring care for rural, primarily minority, patients with type 2 diabetes mellitus	Patients with type 2 diabetes	Weight, blood pressure and HbA1c.	Moderate quality
[27]	USA	2005	To determine whether or not the presence of multiple comorbid medical illnesses affects patient response to a multidisciplinary depression treatment. Improving Mood-Promoting Access to Collaborative Treatment (IMPACT) study	Patients in 60 years or older with depression	Symptom Checklist-90 (SCL-20), the Mental Component Score (MCS of the SF12), overall quality-of-life (QOL of the SF-12), complete remission of depressive symptoms and treatment response.	Moderate quality

Continues

Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[41]	Canada	2010	To evaluate how a primary care reform, which aimed to promote interprofessional and inter-organizational collaborative practices, affected patients' experiences of the core dimensions of primary care	All patients	Patients' perceptions of first-contact accessibility, ongoing care (continuity), service responsiveness and coordination, and comprehensiveness of care (a modified version of the primary care assessment tool).	Low quality
[51]	Scotland	2008	To describe the form and impact of quality improvement work in the Tayside Diabetes Managed Clinical Network	All people with diabetes (type 1 and type 2)	Process measurement: Glycated haemoglobin measured, blood pressure measured, cholesterol measured, creatinine measured, smoking recorded, foot vascular status assessed, foot neurological status assessed, retinal screening.	Low quality
[57]	The Netherlands	2011	To determine the effects of multidisciplinary integrated care on quality of care and quality-of-life for elderly people in residential care facilities	Elderly people in residential home	32 risk-adjusted quality-of-care indicators (developed by Morris), health-related quality-of-life (SF-12), Number of quality-adjusted life-years. Process outcomes: Percentage of residents with completed assessments, the number of multidisciplinary meetings held (minutes of meetings), the number of agreed on medical nursing and social actions, based on content analysis of care plans, and opinions of participating professionals regarding the intervention protocol.	Moderate quality
[64]	New Zealand	2011	To determine whether involvement of community pharmacists undertaking clinical medication reviews, working with general practitioners, improved medicine-related therapeutic outcomes for patients	People 65 years and older (on five or more prescribed medicines)	SF-36 and Medication appropriateness index (MAI).	Moderate quality
[28]	USA	2010	To report the results of 24-hour ambulatory BP monitoring obtained during a pharmacist-physician collaborative model of hypertension management	Patients with uncontrolled hypertension	The 24-hour mean ambulatory systolic blood pressure and diastolic blood pressure.	Moderate quality

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Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[44]	Canada	2011	To demonstrate whether psychologists can integrate within a busy family medicine practice, and examine if family doctors and patients are willing to welcome this health professional in the circle of care.	All patients	Process of chronic disease management: the quality of chronic disease management.	Low quality
[45]	Canada	2009	To determine if there was improvement in medication management when a pharmacist collaborated with family physicians to prescribe medication renewals requested by fax.	All patients with a prescription	Medication-related problems identified and resulting medication changes made, monitoring tests ordered and new appointment schedules.	Low quality
[49]	UK	2010	To estimate the effect of pharmaceutical care on the appropriateness of prescribing: patients' knowledge, adherence and quality-of-life and the incidence of adverse events.	Participants needed to be ≥75 years of age and taking at least five drugs	The UK Medication Appropriateness Index (UK-MAI).	Low quality
[29]	USA	2009	To gain insight into whether coordinated care programs can improve medical treatment plans, reduce avoidable hospital admissions, and promote behavioral and clinical outcomes without increasing costs.	At risk elderly patients with comorbidities	Process outcomes: the percentage of patients who had a lipids panel screening test, the percentage of patients who were in the LDL-C control.	Moderate quality
[30]	USA	2008	To measure the use, cost and quality of care for patients of interdisciplinary primary care teams and compare them to the use, cost and quality of care for patients receiving traditional primary care in the fee-for-service environment in which most elderly persons receive care.	Patients age 65 or older	Use of services (hospitals, skilled nursing facilities, home health agencies, hospice services, outpatient services, physical and occupational therapy and durable medical equipment), quality (number of potentially preventable hospital admissions, i.e. admissions for treatment of five 'ambulatory care sensitive conditions') and costs (payment data).	Low quality
[58]	The Netherlands	2008	To assess to what extent (high levels of) multidisciplinary teamwork and specific types of organizational culture are associated with high quality diabetes care in small office-based general practices.	Patients with type 2 diabetes	HbA1c level, systolic blood pressure and total cholesterol levels. Clinical performance which was measured by 10 process indicators of diabetes care quality.	Low quality

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Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[65]	France	2008	To provide data on GP's opinions on the impact of the consultation-liaison system, on their management of the patients they referred (rather than transferred) to the collaborative system, and on patient medical outcome. And to determine how frequently the family physician remained the primary care provider, alone or in conjunction with a mental health worker, after the shared mental health care intervention.	Patients with mental health problems	Number of joint consultations, health professional satisfaction, patient medical outcome according to health professional.	Low quality
[56]	The Netherlands	2008	Describe the effects of the Dutch Geriatric Intervention Program compared to usual care in improving health-related quality-of-life and promoting successful aging in independently living frail older patients.	Patients 70 years or older	Groningen Activity Restriction Scale (GARS-3), the mental well-being (MOS-20 MH).	Moderate quality
[46]	Canada	2007	To improve both access to and quality of primary health care services in rural Alberta through development, implementation and evaluation of a collaborative partnership between homecare nurses and a family physician practice within the context of a primary health care model	High needs patients who are elderly and who have chronic or complex medical problems	Health system costs, health-related quality-of-life (SF-8 Health Survey), health (rated on the Euroqol (EQ5D) visual analogue scale), Collaborative Practice Scales (2 general factors of assertiveness and cooperation), Index of Work Satisfaction.	Low quality
[59]	The Netherlands	2007	To describe the implementation of a nationwide programme and to determine the effects of specific quality improvement (QI) interventions within this programme on perceived barriers to collaboration between general practitioners (GPs) and mental health professionals and frequency of structural one-on-one contact regarding individual patients.	Patients with mental health problems	Frequency of one-on-one contact between GPs and mental health professionals and perceived barriers before the start of the nationwide programme, exposure of GPs to the interventions, changes in collaboration and perceived barriers between 2001 and 2003, the influence of participation in different interventions on frequency of one-on-one contact and perceived barriers.	Low quality
[47]	Canada	2006	To compare family physicians' reports of their experiences managing patients with psychiatric disorders in settings with and without access to collaborative mental health services.	Patients with psychosis, depression, anxiety, drug or alcohol use, personal disorders, sexual disorders, eating disorders and adjustment disorders	Health professional satisfaction, health professional self-reported knowledge, health professional self-reported skills and degree of comfort in managing psychiatric problems.	Low quality

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Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[22]	USA	2006	To examine the association between the team's overall performance and the risk-adjusted health outcomes of program enrollees	Frail, chronically ill older individuals	Activities of daily living, urinary incontinence (UI), the team's effort to 'right the wrongs' of the regular care system, mortality, risk factors measured by the Short Portable Mental Status Questionnaire.	Low quality
[67]	Israel	2004	Twofold: (1) to determine if the interdisciplinary approach offered by the Western Negev Mobile Clinic Diabetes Program (WNMDCP) is of benefit in patients with poorly controlled type 2 diabetes and (2) to more fully characterize patients' refractory to treatment.	Patients with type 2 diabetes	Response to treatment (a decrease in HbA1c value), Compliance (if patients returned to the follow-up visit).	Low quality
[48]	Canada	2003	To analyse the cost-effectiveness of a pharmacist consultation program for family physicians and their elderly patients.	Elderly patients who were taking at least 5 medications	Reduction in the daily units of medication taken, the number of drug-related problems among the senior citizens, the proportion of recommendations implemented by the physicians, quality-of-life (by SF-36), direct costs, average daily costs.	Low quality
[31]	USA	2003	To compare the effectiveness of an evidence-based, systematic approach to hypertension care involving comanagement of patients by primary care physicians and clinical pharmacists versus usual care in reducing blood pressure in patients with uncontrolled hypertension.	Patients with uncontrolled hypertension	Changes in blood pressure over 12 months, proportion of patients achieving goal blood pressures, costs of antihypertensive drugs, and provider visit costs.	Moderate quality
[52]	UK	2002	To examine whether the style of working relationship between general practices and community mental health teams affects the number and types of referrals from general practices to CMHTs, taking into account population and practice factors and provision of other mental health services which may influence referral rates.	Patients with mental health problems	Short- and long-term referrals to CMHTs and referrals to primary care-based psychology services.	Low quality

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Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[21]	USA	2000	To examine the impact of an interdisciplinary, collaborative practice intervention involving a primary care physician, a nurse, and a social worker for community dwelling seniors with chronic illnesses.	Patients aged 65 years or older with low income	Utilization of medical services and patient-reported health status. To measure utilization: (1) number of hospital admissions, (2) number of patients with 1 or more hospital readmissions within 60 days, (3) mean number of office visits to all physicians, (4) number of patients with 1 or more visits to the emergency department, (5) proportion of patients with 1 or more home care visits, and (6) number of patients with 1 or more nursing home placements. Patient-reported health status: Health activities questionnaire, geriatric depression scale, 3 checklists: social activities, symptoms, nutritional habits; a medication list, the Medical Outcomes Studies 36-item Short Form health Survey.	Moderate quality
[32]	USA	2000	To compare the effectiveness of long-term primary care management by an interdisciplinary geriatric team with usual ambulatory care.	Veterans age 65 years and older	Health status (mortality, global health perception, clinic visits and hospitalizations), Functional status (activities of daily living, instrumental activities of daily living deficits, and perceived global social activity), Quality-of-life (CES-D scale, the Rand general well-being inventory and the perceived global life satisfaction scale), Cognition (Folstein Mini-Mental State Examination (MMSE)).	Moderate quality
[66]	Spain	1999	To identify the characteristics and analyse the variety in the organizational atmosphere (OA) for different disciplines in an autonomous community.	All patients	Organizational atmosphere, measured by teamwork, cohesion and commitment.	Low quality
[34]	USA	1998	To assess the effect of a physician and pharmacist teamwork approach to uncontrolled hypertension in a medical resident teaching clinic.	Patients with uncontrolled hypertension	(percentage of patients who reached) blood pressure goals (established by the JNC-V), and the absolute change in the average two systolic and diastolic blood pressures measurements	Low quality

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Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[35]	USA	1998	To evaluate the function and effectiveness of a multidisciplinary team for managing human immunodeficiency virus (HIV) infection.	HIV patients	A ratio of the use (visits or hospital admission) at intervention compared with control.	Moderate quality
[33]	USA	1997	To assess the effect of a program that encourages teamwork between physicians and pharmacists on attempts to lower total cholesterol levels and to meet recommended goals proposed by the National Cholesterol Education Program.	Patients with total cholesterol levels of 240 mg/dl or higher.	The absolute change in total cholesterol concentration from the baseline enrollment value. The number of risk factors (identified by the National Cholesterol Education Program guidelines) that characterized a patient at study entry and by the presence or absence of coronary heart disease.	Moderate quality
[53]	UK	1999	And to explore the relationship between team structures (size, average tenure of members, fundholding status) and team effectiveness (commitment to patient-centred services, team work, organizational efficiency and health care practice). To explore the relationship between team processes (shared objectives, participation, quality emphasis, support for innovation) and the four dimensions of team effectiveness.	All patients	Measures of team effectiveness: Patient-centred care, organizational efficiency, team working and health care practice. Quality emphasis.	Low quality
[61]	Sweden	2005	To assess whether co-financed teams with personnel from primary care, social insurance and social services have any effect on patients' health status + to assess whether there are any differences regarding change in physical, psychological and social status between patients with musculoskeletal diseases attending the health centres with the co-financed collaboration model and patients attending control health centre.	Patients with musculoskeletal problems	Level of physical activity, occupational function (Canadian Occupational Performance Measure self-care, productivity and leisure), health-related quality-of-life (EuroQol-5).	Low quality
[69]	Puerto Rico	2010	To examine whether a collaborative care model for depression would improve clinical and functional outcomes for depressed patients with chronic general medical conditions in primary care practices in Puerto Rico.	Patients with major depression and chronic general medical conditions (diabetes, hypothyroidism, asthma, hypertension, chronic bronchitis, arthritis, heart disease, high cholesterol, or stroke)	20-item depression scale (HSCL-20) and health-related social functioning status (SF-36).	Moderate quality

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Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[36]	VS	2012	To demonstrate the feasibility of the BRIGHTEN program (Bridging Resources of an Interdisciplinary Geriatric Health Team via Electronic Networking), an interdisciplinary tram intervention for assessing and treating older adults for depression in outpatient primary and specialty medical clinics.	Patients 65 and older with mental health problems	Geriatric Depression Scale and general mental health (SF-12 Mental health component).	Low quality
[60]	The Netherlands	2013	To evaluate whether an interdisciplinary primary care approach for community dwelling frail older people is more effective than usual care in reducing disability and preventing (further) functional decline.	Community dwelling frail older people >70 jaar	Groningen Activity Restriction Scale	High quality
[55]	UK	2013	To compare the clinical effectiveness of collaborative care with usual care in the management of patients with moderate to severe depression.	Patients with moderate to severe depression	Patient health questionnaire (PHQ-9), generalized anxiety disorder 7 (GAD-7), quality-of-life (SF-36) and client satisfaction questionnaire (CSQ-8).	High quality
[17]	USA	2013	To evaluate a primary care practice-based quality improvement (QI) intervention aimed at improving colorectal cancer screening rates.	50 years or older	Colorectal cancer screening rates.	High quality
[37]	USA	2013	To determine effect on surrogate endpoints for cardiovascular disease, a retrospective chart review was performed by patients seen by a multidisciplinary team that provided primary care services in a mobile clinic.	Patients with low income	Systolic Blood pressure, Diastolic blood pressure, heart rate and weight.	Moderate quality
[38]	USA	2012	To examine whether a simple, brief integrated approach to depression and type 2 diabetes treatment improved adherence to oral hypoglycemic agents and antidepressant medications, glycemic control, and depression among primary care patients.	Diabetes type 2 patients with depression	Adherence to antidepressants, HbA1c, patient health questionnaire (PHQ-9).	Moderate quality

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Table A2. (Continued)

References	Country	Year of publication	Objective	Patient population	Outcomes	Quality of the study
[39]	USA	2011	To assess whether VA MEDIC-E (Veterans Affairs Multidisciplinary Education and Diabetes Intervention for Cardiac risk reduction Extended for 6 months), a pharmacist-led shared medical appointments program, could improve attainment of target goals for hypertension, hyperglycemia, hyperlipidemia, and tobacco use in patients with type 2 diabetes compared to standard primary care after 6 months of intervention.	Veterans with type 2 diabetes	A1C, LDL cholesterol, blood pressure, and goal attainment of these values, and diabetes self-care behavior questionnaires.	Moderate quality
[68]	Australia	2012	The authors hypothesized that patients treated for breast cancer would benefit from targeted therapeutic action delivered by general practitioners on the recommendations of a multidisciplinary team based in primary care.	Women with breast cancer	SF 36, Hospital Anxiety and Depression Scale	Moderate quality
[62]	Sweden	2012	To estimate the effect of a multidisciplinary collaboration program on the length of sickness absence.	Individuals who were at risk of becoming long-term sick	Sick spell.	Moderate quality
[40]	USA	2012	To examine the lag between first Primary Care-Mental Health Integration (PC-MHI, to improve the access to mental health care from within primary care) visit and next mental/medical care visit and the relationship of PC-MHI with short-term and long-term use of Veterans Health Administration.	Iraq and Afghanistan War Veterans	Short-term and long-term treatment retention.	Moderate quality